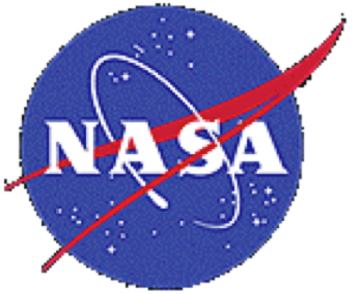


Introduction to NASA Goddard Workshop on Artificial Intelligence

Jacqueline Le Moigne

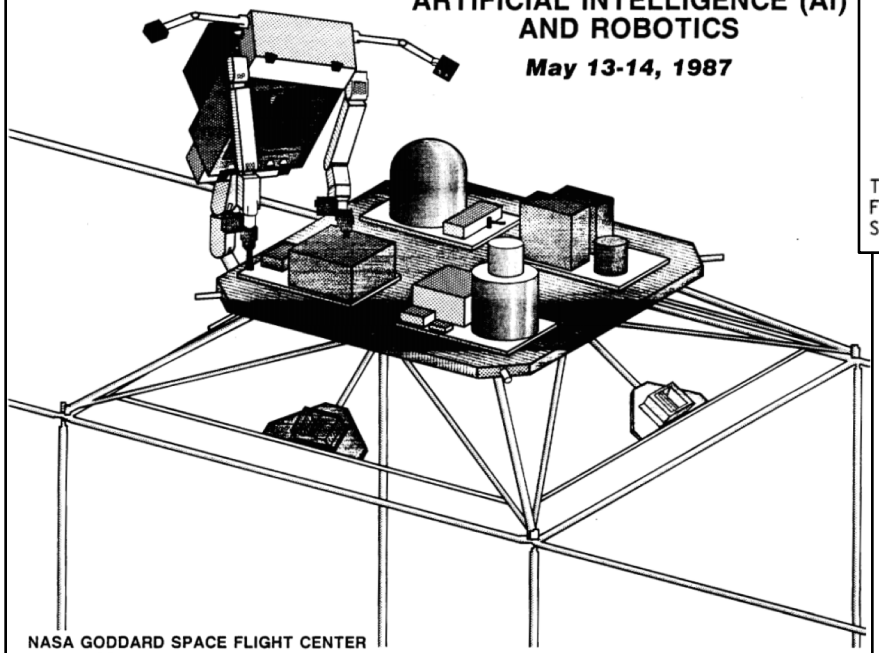
2018/11/27

Welcome to the “First” NASA Goddard Workshop on Artificial Intelligence

PROCEEDINGS OF

1987 GODDARD CONFERENCE on SPACE APPLICATIONS OF ARTIFICIAL INTELLIGENCE (AI) AND ROBOTICS

May 13-14, 1987



NASA GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

(NASA-TM-89663) PROCEEDINGS OF 1987 GODDARD CONFERENCE ON SPACE APPLICATIONS OF ARTIFICIAL INTELLIGENCE (AI) AND ROBOTICS (NASA) 718 p CSCL 22A G3/12

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The 1987 Goddard Conference on Space Applications of Artificial Intelligence (AI) and Robotics was sponsored jointly by the following groups at Goddard Space Flight Center:

Spacecraft Control Programs Branch (Code 514)
Data Systems Technology Division (Code 520)
Telecommunication Systems Branch (Code 531)
Office of Telerobotic Engineering (Code 706)

The conference committee responsible for planning and organizing the conference consisted of:

Willian Macoughtry (co-chairman), Code 514.0
Lloyd Purves (co-chairman), Code 706
Dorothy Perkins, Code 522.1
James Rash, Code 531.1
Carolyn Dent, Code 514.0
Peter Hughes, Code 522.1
Ellen Stolarik, Bendix Field Engineering Corp.
David Beyer, Bendix Field Engineering Corp.
Ronald Littlefield, Bendix Field Engineering Corp.
Beryl Hosack, ORI

These Proceedings were edited and produced as a joint effort by the Bendix Field Engineering Corporation MOSS Software Services and Documentation Services.

1988 Goddard Conference on Space Applications of Artificial Intelligence

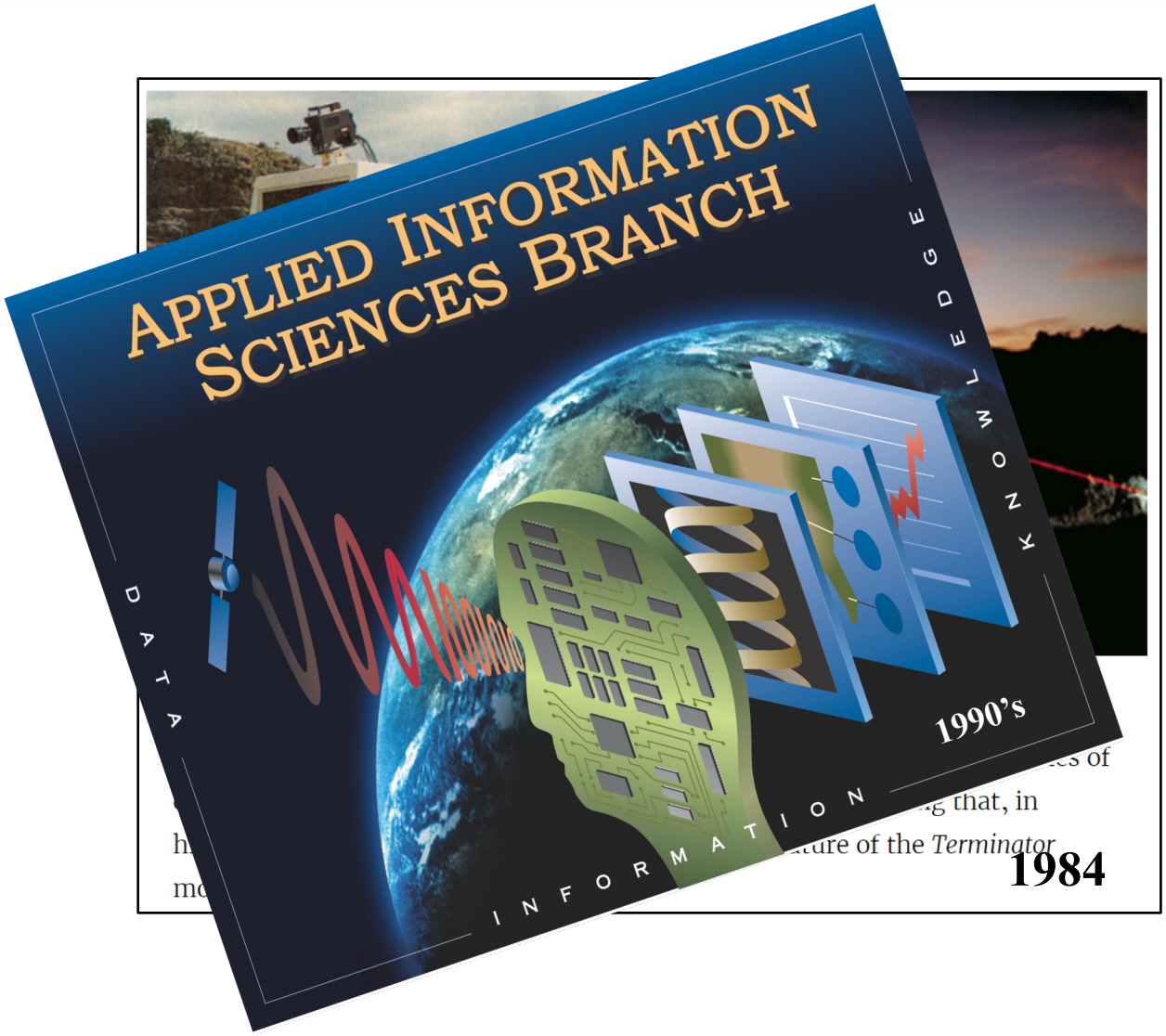
1988-1994, English, Conference Proceedings, Microform edition:
Goddard Conference on Space Applications of Artificial Intelligence [microform] : proceedings of a workshop held at NASA Goddard Space Flight Center, Greenbelt, Maryland ... ...
Goddard Conference on Space Applications of Artificial Intelligence.

Artificial Intelligence from the 1980's to 2018

From 1983 to 1993 DARPA spent over $1 billion on a program called the Strategic Computing Initiative. The agency's goal was to push the boundaries of computers, artificial intelligence, and robotics to build something that, in hindsight, looks strikingly similar to the dystopian future of the *Terminator* movies. They wanted to build Skynet.

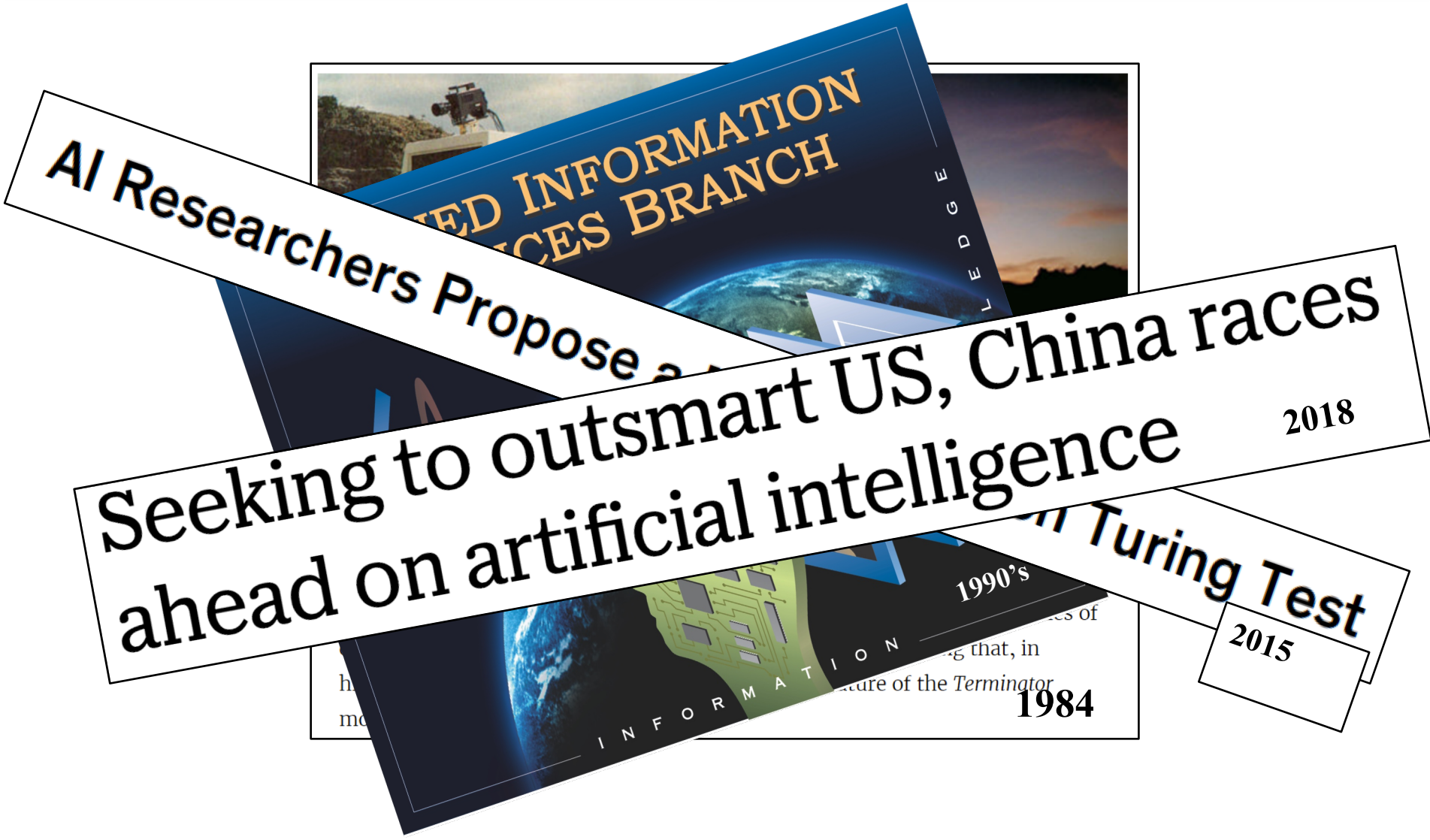
1984

Artificial Intelligence from the 1980's to 2018



Artificial Intelligence from the 1980's to 2018

Artificial Intelligence from the 1980's to 2018



Artificial Intelligence from the 1980's to 2018

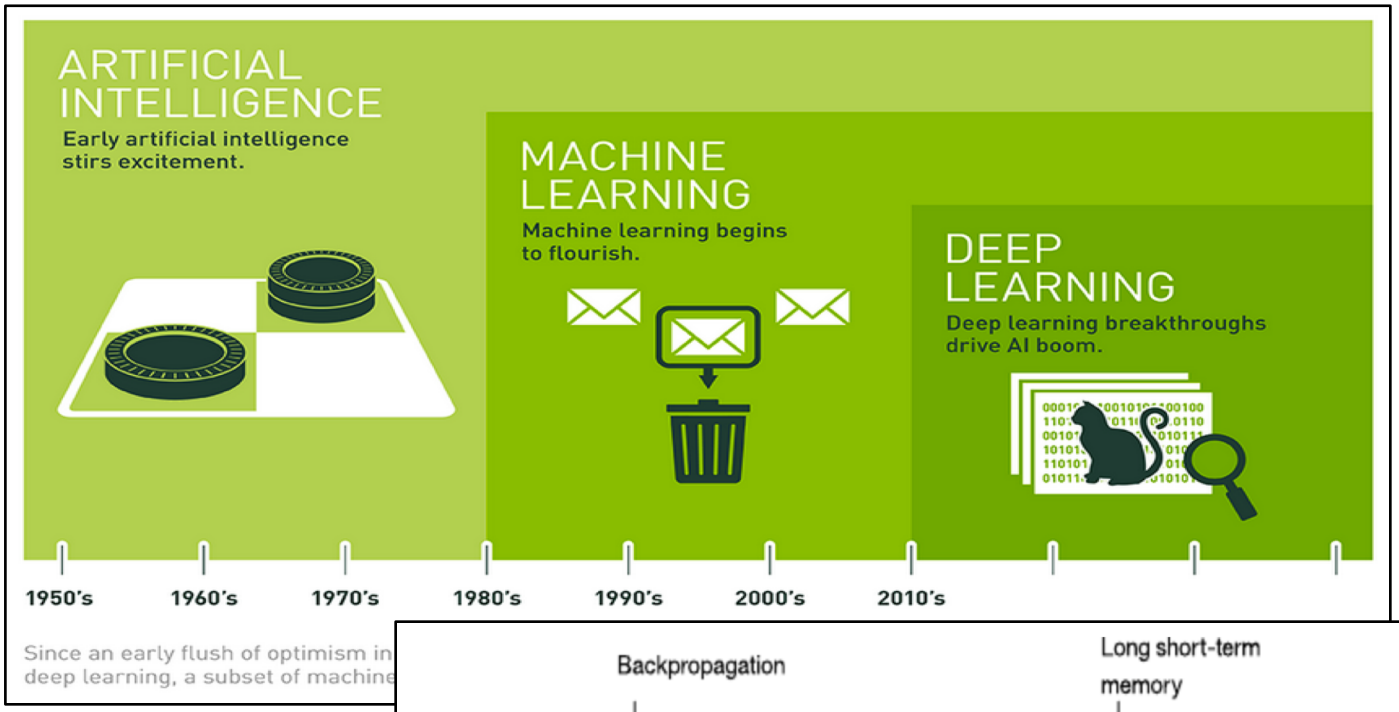
Artificial Intelligence from the 1980's to 2018

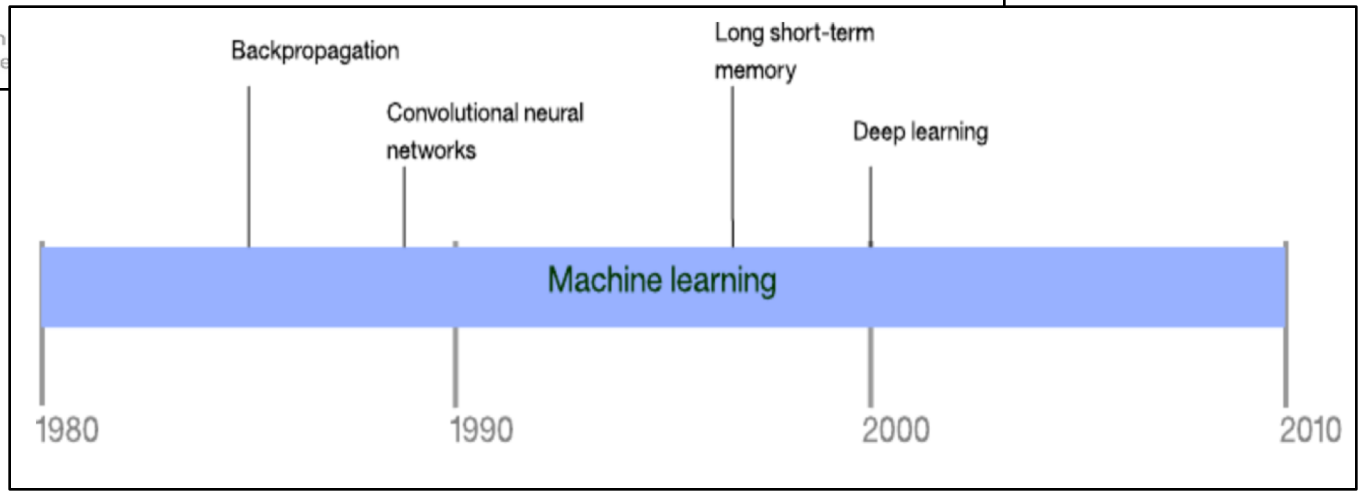
Artificial Intelligence from the 1980's to 2018

Artificial Intelligence from the 1980's to 2018

Artificial Intelligence and Machine Learning

From: https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/



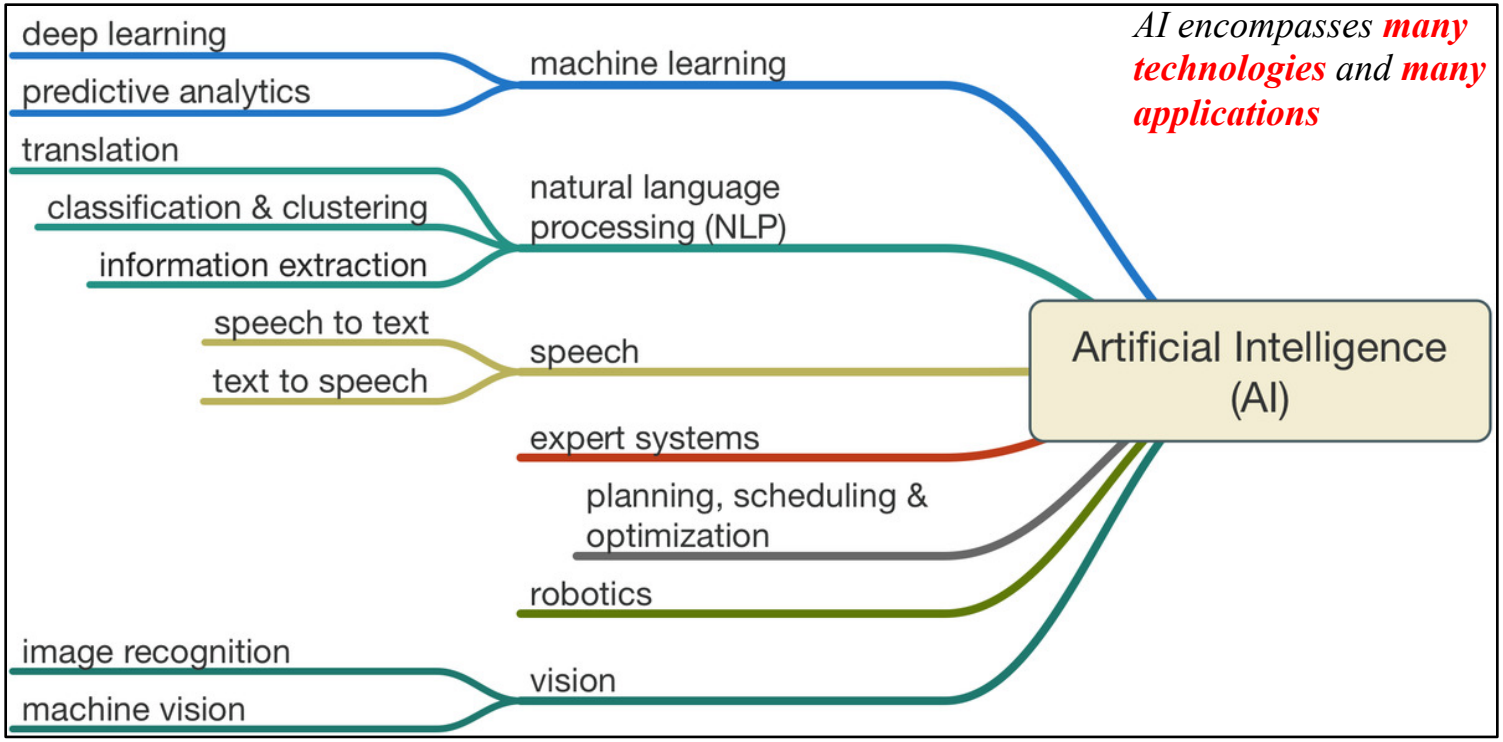


From: https://developer.ibm.com/articles/cc-beginner-guide-machine-learning-ai-cognitive/

What is Artificial Intelligence?

A few definitions:

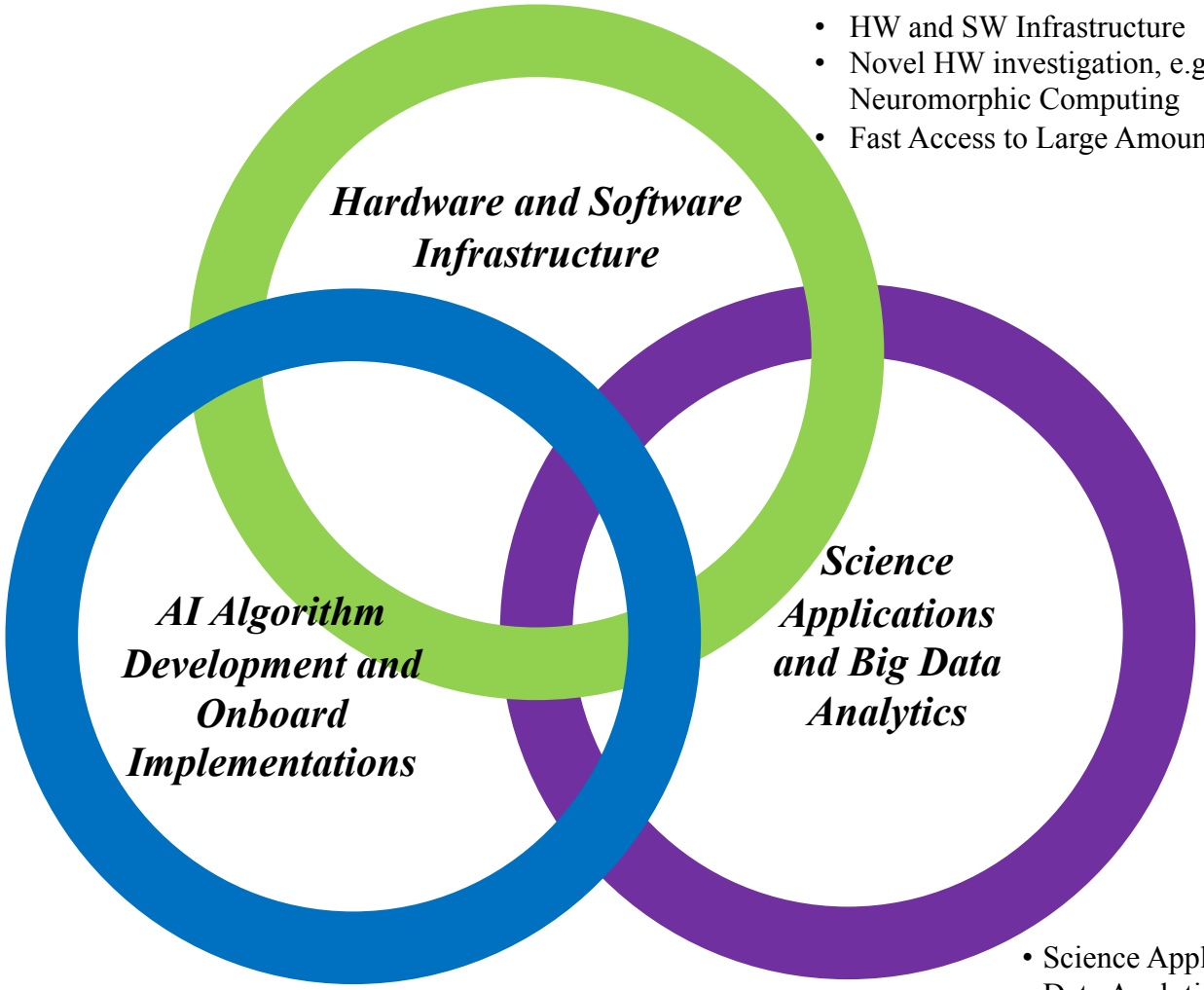
- *Artificial Intelligence (AI)* covers the development of the framework and of the technologies that enable a machine to perceive, reason, plan, act and learn both rationally and humanly.
- *Machine Learning (ML)* covers the sub-field of AI dealing with a machine capable of learning rationally and humanly.
- *Deep Learning (DL)* is a sub-field of Machine Learning dealing with very large Artificial Neural Networks including larger numbers of layers and of neurons, trained with massive amounts of data.



From Terry Fong "Autonomy NASA Capability Leadership Team (CLT) Internal NASA Presentation", Aug. 2018

AI Strategy for NASA Applications

- HW and SW Infrastructure
- Novel HW investigation, e.g., Quantum and Neuromorphic Computing
- Fast Access to Large Amounts of Data



- AI Expertise
- Conceptual Software & Algorithm Development
- Onboard Implementations

- Science Applications and Data Analytics
- Algorithm Relevance and Validation

Collaborations for Successful AI

Business Insider: **"Facebook's chief scientist says that Silicon Valley needs to work more closely with academia to build the future of Artificial Intelligence"**

Yann LeCun, Facebook Aug. 3, 2018, 12:59 PM

Opinion

Facebook's chief AI scientist Yann LeCun. *Facebook*

- **Facebook's chief AI scientist, Yann LeCun, says that letting AI experts split their time between academia and industry is helping drive innovation.**
- **Writing for Business Insider, the executive and NYU professor argues that the dual-affiliation model Facebook uses boosts individual researchers and the industry at large.**
- **A similar model has historically been practiced in other industries, from law to medicine.**

NASA/ Government

Industry

Academia

From: https://www.businessinsider.com/facebook-yann-lecun-dual-affiliation-model-ai-experts-2018-8

Workshop Themes

1. ***General Machine Learning*** (beyond Neural Networks, NN) techniques and their potential applications to the NASA challenges identified above
2. ***Neural Networks and Deep Learning (DL)*** techniques for supervised and unsupervised learning, as well as specific ML techniques such as NN, including but not limited to Convolutional Neural Networks(CNN) and Recurrent Neural Networks (RNN), and more specifically DL
3. ***Image Data Understanding*** of remotely sensed imagery, in particular for Onboard Science Data Analysis
4. ***Computer Vision and Image Processing,*** e.g., for robotic satellite servicing and for extracting and analyzing visual information from documents into higher level information
5. ***Intelligent Advisors*** for NASA Science and Engineering Applications, including Natural Language Processing for providing easier interfaces to complex systems and that will augment or replace simple web interfaces
6. ***Data Analytics***, including Data Mining and Pattern Recognition for Science applications
7. ***Explainable Artificial Intelligence (XAI).*** Explainable AI models that provide useful and relevant information to NASA scientists and engineers will be essential to engender acceptance, improve reliability, and develop trust in AI systems

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